Sexual Dimorphism and Human Evolution

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Introduction

The topic of gender differences must understandably be approached with caution in our modern world. Emotionally charged and fraught with ideas about political correctness, gender can be a difficult subject to address, particularly when discussed in correlation to behavior and social behavior. Throughout history, many people have strove to understand what makes men and women different. Until the modern era, this topic was generally left up to religious leaders and philosophers to discuss. However, with the acquisition of more specialized medical knowledge of human physiology and the advent of anthropology, we now know a great deal more about gender differences than at any other point in history. However, many of our questions still remain.

The purpose of this paper is to discuss the physical aspect of gender differences in humans, otherwise known as sexual dimorphism, it's evolutionary history in our species, and some behavioral and societal trends that are associated with it. To accomplish this, I will begin by outlining the anatomical structures that are commonly used in measuring sexual dimorphism in our species. After establishing these criteria, I will expand upon the
evolutionary history of sexual dimorphism in humans beginning with the anthropoids in the Oligocene and ending with present day trends. I will conclude this paper by discussing some of the behavioral traits that have been thought to correlate with differing degrees of sexual dimorphism and their plausibility.

Anatomical Structures Used to Study Human Sexual Dimorphism

To discuss sexual dimorphism, one must first define the term. Webster’s Dictionary defines sexual dimorphism as “the condition in which differences in structure exist between males and females of the same species”. This should be easy enough to study, given that these differences should be readily apparent for the most part, if they exist at all. In humans, it has long been noted that there are certain physical differences between males and females. The obvious differences refer to the primary sexual characteristics such as genitalia and reproductive organs, but there are many secondary characteristics that also differentiate males and females. Many of these secondary characteristics, however, do not usually present
themselves notably in humans until after puberty (Frayer and Walpoff, 1985).

Among the more obvious of the secondary sexual characteristics is that males, when adequately nourished, tend to be physically larger in size than females. Rogers and Mukherjee (1992) present data that indicates that in most human societies, men are larger than women by roughly ten percent. However, when measuring individuals, size and weight are not always good markers to determine the degree of dimorphism. Both of these factors depend heavily on the quality of nutrition and health the individual has had access to in his or her lifetime. According to Frayer and Wolpoff (1985), undernourished adolescent females will come closer to achieving their genetically defined height and weight than undernourished adolescent males. This means that a researcher must take care when studying the body size of individuals, as the environment may not allow for the expression of ideal size.

Other common skeletal traits used to study sexual dimorphism in humans include differences in dentition and skull features. The identification of both of these traits stems not from the study evolutionary sexual dimorphism, but from forensic anthropology and the need to be able to identify the sex of a skeleton. In all known hominin
groups, males exhibit larger teeth size than females
(Frayer and Walporff, 1985), which is also coupled with an
increase in the size of the brow ridge, jaw bone, and
sagital crest in the skull. Male skull structure tends to
be more robust, while female skull structure tends to be
more gracile. While there is some variation in individuals
that may be caused by genetic conditions (such as
giantism), these traits have been found to be very reliable
in the sexing of skeletons and are therefor adequate ground
for the study of sexual dimorphism. Differences in pelvis
structure are also used in the sexing of skeletons, but
this trait has the more obvious function dealing with
childbirth and reproduction and so is often overlooked.

Many of the other dimorphic traits commonly referenced
deal with bodily traits that cannot be studied well from a
historical point, as they may have no direct effect on the
skeleton, which is all that we have to study of most early
anthropoids. Among these traits are differences in muscle
mass, body fat storage, and developmental growth rates.
Males and females also differ psychologically in certain
respects, but that topic is beyond the scope of this paper.
Discussing sexual dimorphism in human evolutionary history can be a very complicated subject to undertake, as our exact family tree is almost constantly under debate. At one time or another there were as many as four or more species of hominid co-existing at the same time. Also, all we have to postulate by are fragmentary skeletons and teeth, and we have precious few of those. However, some research is available about the differences between our ancestral grandfathers and grandmothers.

The australiopithecines are widely regarded as the precursor to our own genus *Homo*. The two most well-known and widely accepted species of australiopithecine are *australopithecus robustus*, which was more robust as the name suggests, and *australopithecus afarensis*, which was the more gracile (Delson, 1981). There is much controversy over what degree of sexual dimorphism exists in australiopithecine fossils, particularly since there are so many species and subspecies to work with that classifying them is a chore. However, fossils found at Hadar seem to indicate that the amount of dimorphism between australiopithecine males and females was very great indeed. Hominids are often thought to have evolved from primates that were very similar to gorillas and chimpanzees, which
also exhibit a great degree of dimorphism between the sexes, particularly in canine teeth dentition and body size. Therefor, it is not unusual to postulate that australiopithecines might have had similar differences.

Alternative interpretations of the finds at Hadar propose that the skeletons present do not represent a sole, highly dimorphic species, but in fact represent two species, one of which is highly robust while the other is gracile. Given the degree of controversy surrounding the identification of australiopithecine fossils, it is difficult to wager on which interpretation is more valid. Delson (1981) sides with the first interpretation while proposing that the australiopithecus afarensis species is morphologically more similar to late Miocene apes and that this species might sit in the genealogical gap between the genus Homo and later australiopithecines.

In regards to the later genus Homo, analysis of skulls and skeletal fragments from Europe and Africa show a continual decrease in the level of sexual dimorphism throughout the Pleistocene. Although comparatively little is known about the sexual dimorphism of Homo habilis and Homo erectus, the indication is that erectus was significantly more sexual dimorphic than Homo sapiens,
although not more so than *Homo Neanderthalis* (Walpoff, 1976).

*Homo sapiens sapiens* shows the least amount of sexual dimorphism of any of our *Homo* and *Australopithecus* ancestors. In comparison to australopithecines, modern humans have almost identical dentition, body size. The differences in skull facial structure between men and women are the only true skeletal features that hint dramatically at our extremely dimorphic past.

However, many of the sexually dimorphic traits we now study in modern humans, are those we can only speculate about with regards to our ancestors. For instance, the growth of permanent breasts at puberty. Non-human primates, and therefore quite likely our pre-anthropoidal ancestors, only develop breasts when pregnant and nursing and they reabsorb into the body once the offspring has been weaned. In modern humans, the breasts develop at puberty and remain for the female’s lifetime. This trait is often thought to be a part of the evolution of the hidden ovulation cycle. However, this trait has also begun to act as a secondary sexual characteristic used to attract potential mates, since it develops at puberty and now indicates that the female is potentially fertile instead of pregnant and infertile.
Behavior, Social Structure, and Sexual Dimorphism

Differences between males and females, subtle though they are in modern humans, are bound to have an effect on social behavior. It seems that quite a bit of our gender psychology might be wrapped up in our sexual dimorphic past. In this section, I will discuss some of the more major ways in which sexual dimorphism affects our present culture and that of our ancestors.

The most well known correlation in the study of human sexual dimorphism is that of polygamous/monogamous mating habits and body size. Like most modern non-human primates, our distant pre-hominid ancestors probably existed in troops with either a dominant male and a group of females or a mixed group of both males and females. In these types of groups, which are usually polygamous, the males are almost always significantly larger in size than the females.

Indeed, a study of many mammal groups has confirmed that when mammals are polygamous, the males are usually much larger than the females (Mitani, 1996). This characteristic has been attributed to the need for males to
compete with each other for access to the females. Often in primates, when the male is significantly larger than the female, it is often found that the male has much larger canine teeth than the female. Chimpanzees and gorillas are two cases in point. This suggests that if our early ancestors showed a great amount of dimorphism in body mass and canine size between the sexes, then they were statistically more likely to be living in polygamous social groups similar to the way modern apes do.

Modern humans, however, show comparatively little dimorphism and we are a relatively monogamous species. This suggests that males in monogamous species do not have to compete as drastically for mates as those in polygamous species. Therefore, since it requires much more energy to support a larger body than a smaller one, males may have simply evolved through time to a more energy economical state once the reason for the large body size had been eliminated.

However, our polygamous roots are not that far removed in an evolutionary sense from current humans and they are bound to have some effect on our social structure. Possibly, this little bit of sexual dimorphism we have left has contributed to many of our ideas about gender roles. Indeed, in many cultures, there is a wide distinction
between what is considered “women’s work” and “men’s work”. In hunter-gatherer societies, as our pre-historic ancestors also would have lived, it is the men who hunt and make tools while the women who gather and take care of other household duties. This archaic structure has been around so long that is has also worked it’s way into many religious beliefs, resulting in ideas about the nature and appropriate social role of the “weaker sex”. Although our societal values and roles have changed much in modernity, we still carry along a some of our ancestral ideas about men and women today. For instance, women are still barred from combat in the armed forces, and women still receive less pay for the same degree of work.

Another important physiological difference between men and women in modernity is the storage of body fat. Women are much more efficient at storing subcutaneous body fat, thereby resulting in an increased ability to function and develop during times of malnutrition. The reason for this differences is quite obvious. Women’s bodies undergo considerable more physiological stress due to the rigors of pregnancy and they must be able to maintain their own bodies as well as successfully gestate offspring and continue to nurse them afterwards. Men, on the other hand, do not have this problem and so do not need to be more
economical in their subcutaneous fat storage. As we are able to study this factor in modern humans, it seems likely that at least some of our ancestors also had this characteristic.

If trends in human evolution continue as they have been, men and women will decrease in sexual dimorphism until nothing but obvious secondary sexual characteristics like wider hips and breasts in females and primary sexual characteristics remain. Although, it is interesting to note that while females are evolving to be taller now, reaching six feet tall and higher, men are evolving in a parallel fashion to maintain that ten percent larger size. Given that height and size seems to be traits that are selected for in our current populations, we may very well maintain our little bit of sexual dimorphism for quite some time.

Conclusion

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characteristics remain. Although, it is interesting to note that while females are evolving to be taller now, reaching six feet tall and higher, men are evolving in a parallel fashion to maintain that ten percent larger size. Given that height and size seems to be traits that are selected for in our current populations, it is possible that we will maintain our little bit of sexual dimorphism while our society evolves with less separation between the sexes.

We know comparatively little about our early hominid ancestors, but fossils are hard to come by and until they are recovered, we have only what we can infer from current collections and by comparing non-human primates to ourselves. Future research into human sexual dimorphism should properly focus on whether we are actually still losing our physically dimorphic traits or whether it is our culture that is becoming less gender specific.
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